CLAIMS

What is claimed is:

1. An equalizer for a high density optical disc reproducing apparatus, comprising:

a non-linear transformer which transforms an input signal according to predetermined threshold levels;

a cosine transform filter which inverts phases of high frequency spectrum components of an output signal of the non-linear transformer;

a high boost filter which increases amplitudes of high frequency spectrum components of the input signal; and

an adder which adds an output signal of the cosine transform filter with an output signal of the high boost filter.

2. The equalizer of claim 1, wherein the non-linear transformer outputs a difference between the input signal and the threshold level if the amplitude of the input signal exceeds the threshold level, and suppresses the input signal if the amplitude of the input signal is smaller than the threshold level, wherein an output signal b(t) of the non-linear transformer is calculated according to the following Equation:

$$b(t) = \begin{cases} a(t) - U_T, & \text{when } a(t) > U_T \\ a(t) + U_T, & \text{when } a(t) < -U_T, \\ 0, & \text{when } -U_T \le a(t) \le U_T \end{cases}$$

wherein, a(t) is the input signal of the non-linear transformer and U_T and $-U_T$ are the threshold levels of the non-linear transformer.

3. The equalizer of claim 1, wherein the cosine transform filter for (2,10) RLL code input comprises:

four elementary delay lines which are serially connected to each other and delay the output signal of the non-linear transformer;

an adder which adds a final output signal of the elementary delay lines with the input signal; and

a multiplier which multiplies an output signal of the adder with a constant coefficient m, and

an output signal c(t) of the cosine transform filter is calculated according to the following equation:

$c(t) = m(b(t)+b(t-4T))$,

wherein, b(t) is the output signal of the non-linear transformer and T is a delay time of the elementary delay lines.

4. The equalizer of claim 3, wherein Inter-Symbol Interference (ISI) of the output signal of the equalizer is controlled by adaptive suppression of a boost of the high frequency spectrum components of the input signal.

5. The equalizer of claim 4, wherein a value of the ISI depends on a constant coefficient m of the cosine transform filter.

6. The equalizer of claim 5, wherein the constant coefficient m of the cosine transform filter is chosen as large as possible.

7. The equalizer of claim 5, wherein a smaller ISI of the output signal of the equalizer is controlled by selecting the constant coefficient m and the smaller the ISI the smaller an output jitter of the equalizer.

8. The equalizer of claim 1, wherein the cosine transform filter for (1,7) RLL code input comprises:

three elementary delay lines, which are connected to each other and delay the output signal of the non-linear transformer;

an adder which adds a final output signal of the elementary delay lines with the input signal;

a multiplier which multiplies an output signal of the adder with a constant coefficient m, and

an output signal c(t) of the cosine transform filter is calculated according to the following Equation:

$c(t) = m(b(t)+b(t-3T))$,

wherein b(t) is the output signal of the non-linear transformer and T is a delay time of the elementary delay lines.

9. The equalizer of claim 8, wherein Inter-Symbol Interference (ISI) of the output signal of the equalizer is controlled by adaptive suppression of a boost of the high frequency spectrum components of the input signal.

10. The equalizer of claim 9, wherein a value of the ISI depends on a constant coefficient m of the cosine transform filter.

11. The equalizer of claim 9, wherein the constant coefficient m of the cosine transform filter is chosen as large as possible.

12. The equalizer of claim 9, wherein a smaller ISI of the output signal of the equalizer is controlled by selecting the constant coefficient m, and the smaller the ISI the smaller an output jitter of the equalizer.

13. The equalizer of claim 1, wherein the high boost filter for (2,10) RLL code input comprises:

four elementary delay lines which are serially connected to each other and delay the input signal;

inverters which invert the input signal and a final output signal of the elementary delay lines; and

an adder which adds output signals of the inverters with respective output signals of the elementary delay lines, and

an output signal d(t) of the high boost filter is calculated according to the following Equation:

$d(t) = -a(t)+a(t-T)+a(t-2T)+a(t-3T)-a(t-4T)$,

wherein a(t) is an input signal of the high boost filter and T is a delay time of the elementary delay lines.

14. The equalizer of claim 1, wherein the high boost filter for (1,7) RLL code input comprises:

three elementary delay lines which are serially connected to each other and delay the input signal;

inverters which invert the input signal and a final output signal of the elementary delay lines; and

an adder which adds output signals of the inverters with respective output signals of the elementary delay lines, and

an output signal d(t) of the high boost filter is calculated according to the following Equation:

$d(t) = -a(t)+a(t-T)+a(t-2T)-a(t-3T)$,

wherein a(t) is an input signal of the high boost filter and T is a delay time of the elementary delay lines.

15. An equalizing method for a high density optical disc reproducing apparatus, comprising:

transforming and outputting an input signal according to predetermined threshold levels;

inverting and outputting a phase of a high frequency spectrum component of the transformed signal;

increasing and outputting an amplitude of the high frequency spectrum component of the input signal; and

adding the inverted signal with the amplitude-increased signal.

16. The equalizing method of claim 15, wherein the transforming and outputting the input signal according to the predetermined threshold levels comprises outputting a difference between the input signal and the threshold level if the amplitude of the input signal exceeds the threshold level, and completely suppressing the input signal if the amplitude of the input signal is smaller than the threshold level, and wherein the transforming and outputting the input signal according to predetermined threshold levels is performed using the following equation:

$$b(t) = \begin{cases} a(t) - U_T, & \text{when } a(t) > U_T \\ a(t) + U_T, & \text{when } a(t) < -U_T \\ 0, & \text{when } -U_T \le a(t) \le U_T \end{cases},$$

wherein, a(t) and b(t) are the input signal and the transformed signal, respectively, and U_T and $-U_T$ are the threshold levels.

17. The equalizing method of claim 15, wherein the inverting and outputting the phase of the high frequency spectrum component of the transformed signal for (2,10) RLL code input comprises:

delaying and outputting the transformed signal by 4T, wherein T is an elementary delay time period;

adding and outputting the delayed signal with the input signal; and

multiplying and outputting the added signal with a constant coefficient m, and the multiplied signal c(t) is calculated according to the following Equation:

$c(t) = m(b(t)+b(t-4T))$.

18. The equalizing method of claim 17, wherein Inter-Symbol Interference (ISI) of an output signal output by the equalizing method is controlled by adaptive suppression of a boost of the high frequency spectrum component of the input signal.

19. The equalizing method of claim 18, wherein a value of the ISI depends on a constant coefficient m of the cosine transform filter.

20. The equalizing method of claim 18, wherein a smaller ISI of the output signal is controlled by selecting the constant coefficient m, and the smaller ISI ensures a smaller output jitter of the equalizer.

21. The equalizing method of claim 18, wherein the constant coefficient m is selected so that the output signal has minimal jitter.

22. The equalizing method of claim 15, wherein the inverting and outputting the phase of the high frequency spectrum component of the transformed signal for (1,7) RLL code input comprises:

delaying and outputting the transformed signal by a 3T, wherein T is a basic delay time period;

adding and outputting the delayed signal with the input signal; and

multiplying and outputting the added signal with a constant coefficient m, and the multiplied signal c(t) is calculated according to the following Equation:

$c(t) = (b(t)+b(t-3T))$.

23. The equalizing method of claim 22, wherein Inter-Symbol Interference (ISI) of an output signal output by the equalizing method is ensured by adaptive suppression of a boost of the high frequency spectrum component of the input signal.

24. The equalizing method of claim 23, wherein a value of the ISI depends on the constant coefficient m.

25. The equalizing method of claim 23, wherein a smaller ISI of the output signal is ensured by optimally selecting the constant coefficient m, and the smaller ISI ensures smaller output jitter.

26. The equalizing method of claim 23, wherein the constant coefficient m is chosen as large as possible so that the output signal has minimal jitter.

27. The equalizing method of claim 15, wherein the increasing and outputting the amplitude of the high frequency spectrum component of the input signal for (2,10) RLL code input comprises:

delaying the input signal with an elementary delay time (T) unit and outputting a signal delayed by 1T, a signal delayed by 2T, a signal delayed by 3T, and a signal delayed by 4T;

inverting the input signal and the 4T delayed signal and outputting first and second inverted signals; and

adding the first and the second inverted signals with the 1T, the 2T, and the 3T delayed signals, and outputting the added signal, and

the added signal d(t) is calculated according to the following Equation:

$d(t) = -a(t)+a(t-T)+a(t-2T)+a(t-3T)-a(t-4T)$.

28. The equalizing method of claim 15, wherein the increasing and outputting the amplitude of the high frequency spectrum component of the input signal for (1,7) RLL code input comprises:

delaying the input signal with an elementary delay time T and outputting a signal delayed by 1T, a signal delayed by 2T, and a signal delayed by 3T;

inverting the input signal and the 3T delayed signal and outputting the first and the second inverted signals; and

adding the first and the second inverted signals with the 1T and the 2T delayed signals, and outputting the added signal, and

the added signal d(t) is calculated according to the following Equation:

$d(t) = -a(t)+a(t-T)+a(t-2T)-a(t-3T)$.

29. An equalizing method for a reproducing apparatus of a high density optical recording medium, the method comprising:

detecting a difference component between a signal component of an input signal and a predetermined threshold level when the signal component of the input signal exceeds the predetermined threshold level;

increasing amplitudes of high frequency spectrum components of the input signal and outputting low frequency spectrum components of the input signal without increasing Inter-Symbol Interference; and

adaptively suppressing the increased amplitudes of the high frequency spectrum components by the difference component.

30. The equalizing method of claim 29, wherein the detecting the difference component between the signal component of the input signal and the predetermined threshold level when the signal component of the input signal exceeds the predetermined threshold level outputs the difference component between the amplitude of the input signal and the threshold level if the amplitude of the input signal exceeds the threshold level, and suppresses the input signal if the amplitude of the input signal is smaller than the threshold level.

31. The equalizing method of claim 29, wherein the adaptively suppressing the increased amplitudes of the high frequency spectrum components by the difference component suppresses the maximum amplitude of the high frequency component so that the output signal has minimal jitter.

32. A reproducing apparatus for a high density optical recoding medium, comprising:

detecting means, detecting a difference component between a signal component of an input signal and a predetermined threshold level when the signal component of the input signal exceeds the predetermined threshold level;

amplitude increasing means, increasing and outputting amplitudes of high frequency components of the input signal and outputting lower frequency components of the input signal without increasing Inter-Symbol Interference; and

amplitude controlling means, adaptively suppressing an amplitude of a high frequency component output from the amplitude increasing means, in response to the difference component, and reducing Inter-Symbol Interference of the output signal.

33. The equalizer of claim 32, wherein the detecting means outputs a difference between the input signal and the threshold level if the amplitude of the input signal exceeds the threshold level, and suppresses the input signal if the amplitude of the input signal is smaller than the threshold level.

34. The equalizer of claim 32, wherein the amplitude controlling means suppresses the amplitude of the high frequency component so that the output signal has minimal jitter.